

Boiler Group Chair/Co-Chair

ICCR Boiler Source Work Group

Attached is a table entitled HAPs Selection and Test Methods for Oil Fired Boilers. The list contains the names of the 189 Hazardous Air Pollutants (HAPs) that have, based on experience, been screened for potential presence in emissions from oil fired boilers. This preliminary screening has been performed on the list by the Testing and Monitoring Protocol Work Group (TMPWG). This table is being forwarded to the Boiler Source Work Group (SWG) for review and comment.

The table includes HAPs that may be present in these emissions. Additionally, a listing of testing methods that have been used and have the potential to quantify the HAPs presence in flue gas emissions are included.

For those HAPs that are not included in the list, a codified reason for their exclusion is provided. Exclusion codes include:

- 1- Compound is not expected to be emitted from source because basic chemical or physical principles do not favor its existence in source exhaust.
- 2 - Existing test data indicate that compound is not emitted in significant quantities from source.

Other exclusion codes are included as appropriate.

It should be noted that this table is general in its first draft and represents the extent of the TMPWG's knowledge and experience with emissions from oil fired boilers. Please review carefully from a standpoint of those HAPs included as well as those HAPs excluded. The subgroup within the TMPWG that is responsible for the development of this table has included a preface that provides the sources of information utilized to develop the table, the rationale for exclusion codes, and the names of the TMPWG contact for the Boiler SWG.

If we can be of service in any other fashion or if you have any questions concerning in the table, please contact Tom McGrath (e-mail: "eertommc@hotmail.com") the TMPWG member who is monitoring the activities of your SWG.

HAP Selection and Test Methods for Oil Fired Boilers

Most source testing studies have been carried out to measure criteria pollutant emissions (NOX, SO2, etc.) and not HAPs. The category "oil fired boilers" can encompass a range of fuels from diesel to Bunker No. 6. Therefore an initial review of the analytical data on the fuel is helpful and may result in eliminating categories of compounds of HAPs. While bromine is not present in oils, chlorine may be present in some fuel oils and the HAP table provided here includes that possibility.

Combustion is a strongly oxidizing process and many compounds are not stable under these conditions, this results in a further reduction of potential HAPs. Compounds included in this list were selected on the basis of their presence in the emissions database developed in California in accord with the requirements of California State Assembly Bill 2588.

- "AB 2588 Pooled Source Emissions Test Program", The Almaga Corporation Project Project I6511, The Almaga Corporation Report I6551-4
- "Pooled Source Testing of Combustion Devices: Database Users Guidance Manual", Energy and Environmental Research Corporation, Irvine CA 92718

Additional emissions test information was provided in an EPA report which addressed HAP emissions from a variety of coal, oil, and gas fired utility boilers.

- "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units-- Interim Final Report", US Environmental Protection Agency Report, EPA-454/R-96-013, October 1996

HAPS Selection and Test Methods for Source Category

Source Category: **Oil-Fired Boilers**

Include in List	CAS No.	Chemical name	If excluded, give reason for exclusion (use codes where appropriate)	If Included, give applicable test method(s)
x	75070	Acetaldehyde		EPA 0011 CARB 430
	60355	Acetamide		1
	75058	Acetonitrile		1
	98862	Acetophenone		1
	53963	2-Acetylaminofluorene		1
	107028	Acrolein		1
	79061	Acrylamide		1
	79107	Acrylic acid		1
	107131	Acrylonitrile		1
	107051	Allyl chloride		1
	92671	4-Aminobiphenyl		1
	62533	Aniline		1
	90040	o-Anisidine		1
	1332214	Asbestos		1
x	71432	Benzene		EPA 18, 0030, 5040
	92875	Benzidine		1
	98077	Benzotrichloride		1
	100447	Benzyl chloride		1
	92524	Biphenyl		1
	117817	Bis(2-ethylhexyl)phthalate (DEHP)		1
	542881	Bis(chloromethyl)ether		1
	75252	Bromoform		1
	106990	1,3-Butadiene		2
	156627	Calcium cyanamide		1
	133062	Captan		1
	63252	Carbaryl		1
	75150	Carbon disulfide		1
	56235	Carbon tetrachloride		1
	463581	Carbonyl sulfide		1
	120809	Catechol		1
	133904	Chloramben		1
	57749	Chlordane		1
	7782505	Chlorine		1
	79118	Chloroacetic acid		1
	532274	2-Chloroacetophenone		1
	108907	Chlorobenzene		1
	510156	Chlorobenzilate		1
	67663	Chloroform		1
	107302	Chloromethyl methyl ether		1
	126998	Chloroprene		1
	1319773	Cresols/Cresylic acid (isomers and mixture)		1

	95487	o-Cresol		1
	108394	m-Cresol		1
	106445	p-Cresol		1
	98828	Cumene		1
	94757	2,4-D, salts and esters		1
	3547044	DDE		1
	334883	Diazomethane		1
	132649	Dibenzofurans		1
	96128	1,2-Dibromo3-chloropropane		1
	84742	Dibutylphthalate		1
	106467	1,4-Dichlorobenzene(p)		1
	91941	3,3-Dichlorobenzidene		1
	111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)		1
	542756	1,3-Dichloropropene		1
	62737	Dichlorvos		1
	111422	Diethanolamine		1
	121697	N,N-Diethyl aniline (N,N-Dimethylaniline)		1
	64675	Diethyl sulfate		1
	119904	3,3-Dimethoxybenzidine		1
	60117	Dimethyl aminoazobenzene		1
	119937	3,3-Dimethyl benzidine		1
	79447	Dimethyl carbamoyl chloride		1
	68122	Dimethyl formamide		1
	57147	1,1-Dimethyl hydrazine		1
	131113	Dimethyl phthalate		1
	77781	Dimethyl sulfate		1
	534521	4,6-Dinitroo-cresol, and salts		1
	51285	2,4-Dinitrophenol		1
	121142	2,4-Dinitrotoluene		1
	123911	1,4-Dioxane (1,4-Diethyleneoxide)		1
	122667	1,2-Diphenylhydrazine		1
	106898	Epichlorohydrin (1-Chloro-2,3-epoxypropane)		1
	106887	1,2-Epoxybutane		1
	140885	Ethyl acrylate		1
	100414	Ethyl benzene	Exclusion Code	2
	51796	Ethyl carbamate (Urethane)		1
	75003	Ethyl chloride (Chloroethane)		1
	106934	Ethylene dibromide (Dibromoethane)		1
	107062	Ethylene dichloride (1,2-Dichloroethane)		1
	107211	Ethylene glycol		1
	151564	Ethylene imine (Aziridine)		1
	75218	Ethylene oxide		1
	96457	Ethylene thiourea		1
	75343	Ethylidene dichloride (1,1-Dichloroethane)		1
x	50000	Formaldehyde	EPA 0011 CARB 430	
	76448	Heptachlor		1
	118741	Hexachlorobenzene		1
	87683	Hexachlorobutadiene		1
	77474	Hexachlorocyclopentadiene		1
	67721	Hexachloroethane		1
	822060	Hexamethylene-1,6-diisocyanate		1
	680319	Hexamethylphosphoramide		1
	110543	Hexane		1
	302012	Hydrazine		1
	7647010	Hydrochloric acid		1
	7664393	Hydrogen fluoride (Hydrofluoric acid)		1
	7783064	Hydrogen sulfide		1
	123319	Hydroquinone		1
	78591	Isophorone		1
	58899	Lindane (all isomers)		1
	108316	Maleic anhydride		1
	67561	Methanol		1
	72435	Methoxychlor		1

	74839	Methyl bromide (Bromomethane)	1
	74873	Methyl chloride (Chloromethane)	1
x	71556	Methyl chloroform (1,1,1-Trichloroethane)	EPA 18, 0030, 5040
	78933	Methyl ethyl ketone (2-Butanone)	1
	60344	Methyl hydrazine	1
	74884	Methyl iodide (Iodomethane)	1
	108101	Methyl isobutyl ketone (Hexone)	1
	624839	Methyl isocyanate	1
	80626	Methyl methacrylate	1
	1634044	Methyl tert butyl ether	1
	101144	4,4-Methylene bis(2-chloroaniline)	1
x	75092	Methylene chloride (Dichloromethane)	EPA 18, 0030, 5040
	101688	Methylene diphenyl diisocyanate (MDI)	1
	101779	4,4-Methylenedianiline	1
	91203	Naphthalene	2
	98953	Nitrobenzene	1
	92933	4-Nitrobiphenyl	1
	100027	4-Nitrophenol	1
	79469	2-Nitropropane	1
	684935	N-Nitroso-Nmethylurea	1
	62759	N-Nitrosodimethylamine	1
	59892	N-Nitrosomorpholine	1
	56382	Parathion	1
	82688	Pentachloronitrobenzene (Quintobenzene)	1
	87865	Pentachlorophenol	1
x	108952	Phenol	EPA 0010, CARB 429
	106503	p-Phenylenediamine	1
	75445	Phosgene	1
	7803512	Phosphine	1
	7723140	Phosphorus	1
	85449	Phthalic anhydride	1
	1336363	Polychlorinated biphenyls (Aroclors)	1
	1120714	1,3-Propane sultone	1
	57578	beta-Propiolactone	1
	123386	Propionaldehyde	1
	114261	Propoxur (Baygon)	1
	78875	Propylene dichloride (1,2-Dichloropropane)	1
	75569	Propylene oxide	1
	75558	1,2-Propylenimine (2-Methyl aziridine)	1
	91225	Quinoline	1
	106514	Quinone	1
	100425	Styrene	1
	96093	Styrene oxide	1
x	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 23, CARB 428
	79345	1,1,2,2-Tetrachloroethane	1
	127184	Tetrachloroethylene (Perchloroethylene)	2
	7550450	Titanium tetrachloride	1
x	108883	Toluene	EPA 18, 0030, 5040
	95807	2,4-Toluene diamine	1
	584849	2,4-Toluene diisocyanate	1
	95534	o-Toluidine	1
	8001352	Toxaphene (chlorinated camphene)	1
	120821	1,2,4-Trichlorobenzene	1
	79005	1,1,2-Trichloroethane	1
	79016	Trichloroethylene	1
	95954	2,4,5-Trichlorophenol	1
	88062	2,4,6-Trichlorophenol	1
	121448	Triethylamine	1
	1582098	Trifluralin	1
	540841	2,2,4-Trimethylpentane	1
	108054	Vinyl acetate	2
	593602	Vinyl bromide	1
	75014	Vinyl chloride	1

	75354	Vinylidene chloride (1,1-Dichloroethylene)		1	
x	1330207	Xylenes (isomers and mixture)		EPA 18, 0030, 5040	
	95476	o-Xylenes		2	
x	108383	m-Xylenes		EPA 18, 0030, 5040	
x	106423	p-Xylenes		EPA 18, 0030, 5040	
x	N/A	Antimony Compounds		EPA 29, 0012	
x	N/A	Arsenic Compounds (inorganic including arsine)		EPA 29, 0012	
x	N/A	Beryllium Compounds		EPA 29, 0012	
x	N/A	Cadmium Compounds		EPA 29, 0012	
x	N/A	Chromium Compounds		EPA 29, 0012	
x	N/A	Cobalt Compounds		EPA 29, 0012	
	N/A	Coke Oven Emissions		1	
	N/A	Cyanide Compounds *1		1	
	N/A	Glycol ethers *2		1	
x	N/A	Lead Compounds		EPA 29, 0012	
x	N/A	Manganese Compounds		EPA 29, 0012	
x	N/A	Mercury Compounds		EPA 29, 0012	
	N/A	Fine mineral fibers *3		1	
x	N/A	Nickel Compounds		EPA 29, 0012	
				EPA 0010, 8270	CARB
x	N/A	Polycyclic Organic Matter *4		429	
	N/A	Radionuclides (including radon) *5		1	
x	N/A	Selenium Compounds		EPA 29, 0012	